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Description of a gynandromorphic *Myrmilla calva* (VILLIERS 1789), with a summary on gynandromorphism phenomenon within Mutillidae (Hymenoptera: Scolioidea)

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A b s t r a c t : A gynandromorphic specimen of Mutillidae belonging to *Myrmilla calva* (VILLIERS 1789) is described and illustrated. The gynandromorph has a general female-like appearance, with mixed female-male characters located only on apical part of metasoma. In detail, the head and mesosoma are entirely and normally female-like, the latter without wings, whereas the metasoma has the last two segments male-like, with fully and normally developed genital capsule. Based upon the classification proposed by DALLA TORRE & FRIESE (1899), the deviant specimen is a mixed gynandromorph belonging to the group III, having deviant characters along sagittal line. A brief discussion on the occurrence of the phenomenon of gynandromorphism within the family Mutillidae is provided.

K e y w o r d s : Mutillidae, *Myrmilla calva*, gynandromorph, description.

Introduction

Gynandromorphs are sexually abnormal individuals that show deviant phenotypes in the expression of female and male characters, exhibited in the same tagmata or part of them. They are normally rare or very rare in nature, thus not frequently collected. This phenomenon is widespread among animals, mainly invertebrates (e.g., Araneae, Crustacea, and many orders of Insecta) and less frequently among Vertebrata (Aves and Mammalia) with a few controversial cases (BENOIT 1950; ABELLA 2002).

Within Hymenoptera, the phenomenon of gynandromorphism has been most frequently documented in Formicidae (see for instances WHEELER 1903; ADLERZ 1908; SCUPOLA 1994), and less frequently in other groups such as Diprionidae (MARTINI et al. 1999), Siricidae (NEUMANN 1970), Tenthredinidae (PEACOCK 1925), Trichogrammatidae (BESERRA et al. 2003), Encyrtidae (ZHANG & ZHU 2007), Scelionidae (HUGGERT 1977), Chalcididae (HALSTEAD 1988), Agaonidae (PEREIRA et al. 2003), Ichneumonidae (TARASCO 1996), Braconidae (WHITING & WHITING 1927), Scoliidae (KROMBEIN 1949), Mutillidae (MAEKLIN 1856; WHEELER 1910; MANN 1915; MICKEI 1928, 1935; BISCHOFF 1913, 1931; NONVEILLER 1973; QUINTERO & CAMBRA 1994; TURRISE 1999), Eumenidae (COOPER 1959; TURRISE & BORSATO 2008), Sphecidae (SCHNEIDER & FEITZ 2003), and Apoidea (e.g., ORNOSA et al. 2001; WCISLO et al. 2004).

In this note a new case of gynandromorphism within Mutillidae, affecting *Myrmilla calva* (VILLIERS 1789), is described and illustrated.

Material and Methods

Examination of the gynandromorph was made under light stereomicroscope Wild M5A; description was made upon comparison with normal male and female specimens of the same species, in order to recognize deviant mixed female-male features. Terminology for morphology follows GAULD & BOLTON (1996), that for surface sculpturing follows HARRIS (1979). The classification of the gynandromorph is based on DALLA TORRE & FRIESE (1899). Abbreviations in the text: T= tergite; S= sternite.

Description of gynandromorph

Myrmilla calva (VILLIERS 1789) (Figs 1-3)

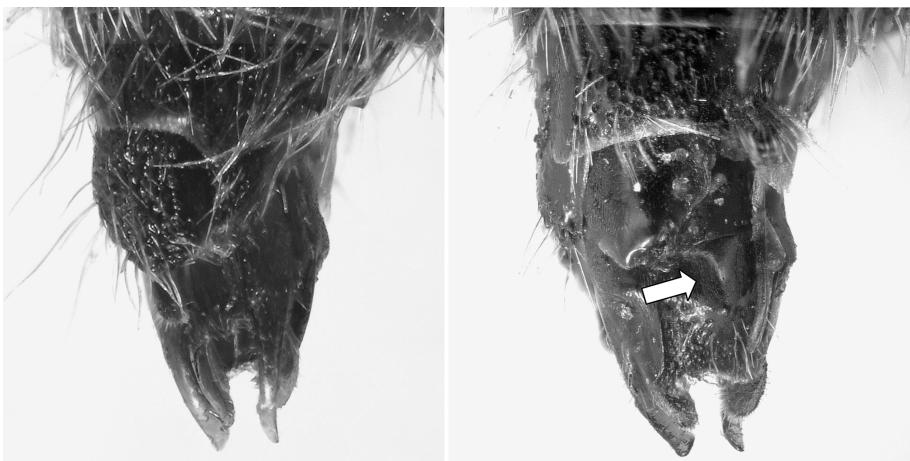
M a t e r i a l e x a m i n e d : 1 specimen from Spain: Catalonia, Cambrils de Mar, 27.V.1990, H. Tussac leg. (coll. A. Foucart, Montpellier).

D e s c r i p t i o n . Length: 7.5 mm. General appearance female-like (Fig. 1). Head entirely and normally female-like, reddish-brown, lighter in middle, with scattered recumbent or semi erect brown setae, except on vertex, bearing shorter recumbent goldish setae; antennae 12-segmented; mandibles strongly enlarged toward apex, with one median tooth on inner margin and three apical teeth; maxillo-labial complex female-like, normally developed. Mesosoma entirely female-like, reddish-orange with sides darkened, without wings; dorsal sclerites completely fused; legs female-like, covered with erect or semi erect long setae; mid- and hind legs with 5 long and strong spines along latero-dorsal margin. Metasoma blackish, with mixed male and female characters; shape, pubescence and sculpture of metasomal segments 1-5 female-like; segment 1 transverse, widely attached to following segment, bearing two well developed anterolateral lamellae; T1 with fine and dense punctures (distance between punctures 1.0× or less diameter of a puncture), mixed up with a few coarser punctures, bearing an apical band of whitish pubescence; metasomal segment 2 representing most part of metasoma (more than half length), from above, with weakly convex sides; T2 punctate-rugose, with coarse and dense punctures (distance between puncture less than 1.0× diameter of a puncture), except along apical margin, with fine and dense punctures, bearing moderately dense mixed-up whitish/blackish and recumbent/erect setae, and an apical band of whitish pubescence, wider in middle; S2 regularly convex, without median conical process; metasomal segments 4-5 with recumbent mostly whitish setae, resembling continuous bands; S1-5 bearing scattered setae and coarse and scattered punctures; metasomal segments 6-7 male-like, with tergites bearing very coarse and dense punctures and scattered recumbent setae; S7 bearing a normally developed median conical process. Genital male capsule fully and normally developed (Figs 2-3).

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Fig. 1: *Myrmilla calva* (VILLIERS 1789), gynandromorph specimen, habitus.



Figs 2-3: *Myrmilla calva* (VILLIERS 1789), gynandromorph specimen, metasomal segments and genital capsule in dorsal (2) and ventral (3) view. T7 a little turned on the left; arrow indicates the conical median process on S7.

Discussion

According to the classification proposed by DALLA TORRE & FRIESE (1899), based on the topology of mixed female-male characters, gynandromorphs are classified in 4 main groups and 14 subgroups, namely: 1) lateral deviants (group I), with each side of one or more tagmata showing different sexual traits; 2) transverse deviants (group II), having different sexual characters on dorsal and ventral surfaces; 3) frontal deviants (group III), having different sexual characters along sagittal axis; 4) mixed deviants (group IV), having combinations of the previous deviant patterns.

The gynandromorphic specimen of *Myrmilla calva* described, clearly belongs to the group III, having head, mesosoma and part of metasoma female-like, and remaining part of metasoma male-like, with fully and normally developed genital capsule.

A recognition on literature reveals that the phenomenon of gynandromorphism within Mutillidae has been documented for a total of only twelve species (Tab. 1), belonging to Myrmosinae (one species), Myrmillinae (two species), Mutillinae (three species of different tribes: Mutillini, Smicromyrmmini and Trogaspidiini), Sphaeropthalminae (six species). Based on the classification after DALLA TORRE & FRIESE (1899), the described gynandromorphs belong to all the four main groups: a) five to group I (lateral deviants); b) only one to group II (transverse deviants); c) two to group III (frontal deviants); d) three to group IV (mixed deviants).

The occurrence of the phenomenon of gynandromorphism within Mutillidae seems to be very rare: NONVEILLER (1973) recorded only two gynandromorphs out of a total of 100.000 specimens examined by himself, and QUINTERO & CAMBRA (1994) reported two gynandromorphs after examination by themselves of more than 15.000 specimens. The study of the phenomenon of gynandromorphism within Mutillidae is interesting not only for pure aim of knowledge, but also because it provides the possibility to recognize both female and male characters in the same specimen, allowing to join the different sexes with reasonable certainty, and thus to solve taxonomic problems depending on descrip-

tion of each sex of the same species under different taxa, due to the pronounced sexual dimorphism of mutillids, with females always wing-less and males mostly alate (cfr. NONVEILLER 1973).

Zusammenfassung

Ein gynandromorphes Exemplar einer *Myrmilla calva* (VILLIERS 1789) (Mutillidae) wurde beschrieben und abgebildet. Habituell gleicht das Tier einem Weibchen mit gemischtgeschlechtlichen Merkmalen an der Spitze des Metasomas. Kopf und Mesosoma sind gänzlich und normal in weiblicher Form ausgebildet, flügellos, die letzten zwei Segmente des Metasoma sind in männlicher Art vorliegend, mit kompletter und typischer Genitalkapsel. Der Arbeit von DALLA TORRE & FRIESE (1899) folgend, handelt es sich beim studierten Exemplar um eine gynandromorphe Form der Gruppe III. Es wird kurz das Phänomen der Gynandromorphie innerhalb der Familie der Mutillidae diskutiert.

Résumé

Un spécimen gynandromorphe de Mutillidae appartenant à *Myrmilla calva* (VILLIERS 1789) est décrit et illustré. Le gynandromorphe a une apparence générale semblable à la femelle, avec des caractères mélangés féminins-masculins placés seulement sur metasoma. En détail, la tête et le mesosoma sont entièrement femelle et donc sans ailes tandis que le metasoma a ses deux derniers segments mâle, avec la capsule génitale entière et bien développée. Basé sur la classification proposée par DALLA TORRE & FRIESE (1899), le spécimen déviant est un gynandromorphe mélangé appartenant au groupe III, possédant des caractères déviants suivant une coupe sagittale. On fournit une brève discussion sur le phénomène du gynandromorphisme observé dans la famille des Mutillidae.

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Tab. 1: Summary of described cases of gynandromorphism in Mutillidae, with topology of deviant mixed female-male characters and the group according to the classification proposed by DALLA TORRE & FRIESE (1899).

Species	Reference	Group	Head	Mesosoma	Metasoma
<i>Mutilla europaea</i> LINNAEUS 1758	MAEKLIN (1856)	I	left half male/right half female	left half male/right half female	left half male/right half female
<i>Pseudomethoca frigida</i> (SMITH 1855)	WHEEER (1910)	I	left half female/right half male	left half female/right half male	left half female, including part of genitalia/right half male, including part of genitalia
<i>Myrmosa atra</i> PANZER 1801	BISCHOFF (1913)	I	left half female including antenna 12-segmented/right half male including antenna 13-segmented	female	female (right half of T1 deformed but not recognizable as male trait)
<i>Dasymutilla vestita</i> (LEPELETIER 1845)	MANN (1915)	I	left half female/right half male	left half male/right half female; wings absent	left half male including part of genital capsule/right half female including part of genitalia
<i>Dasymutilla cypris</i> (BLAKE 1871)	MICKEL (1928)	III	entirely male	entirely male	segments 1-4 female; segments 5-7 male
<i>Traumatomutilla dubia</i> (FABRICIUS 1804)	BISCHOFF (1931)	IV	entirely male	entirely male	segment 1 male; remaining parts mosaic
<i>Dasymutilla gloriosa</i> (SAUSSURE 1868)	MICKEL (1936)	not indicated	not described	not described	not described
<i>Trogaspidia niveitegulata</i> BISCHOFF 1920	NONVEILLER (1973)	IV	entirely male	entirely male	six segments as female; segment 1 male; T2-3 mosaic; remaining parts female
<i>Smicromyrme varians</i> ANDRÉ 1904	NONVEILLER (1973)	II	entirely female	pronotum, mesonotum and metanotum male; wings vestigial; remaining parts, including legs, female	entirely female
<i>Pseudomethoca areta</i> (CAMERON 1895)	QUINTERO & CAMBRA (1994)	IV	entirely female	entirely female	T1 male; T2 left/right mosaic; T3 partial left/right mosaic; segments 4-6 female; sternites left/right mosaic, except S3 female
<i>Myrmilla bison</i> (A. COSTA 1887)	TURRISI (1999)	I	left half male/right half female; antennae and supra-antennal horns female (right antenna darker as male)	left half male/right half female; legs female (right legs darker as male)	female; presence of sting, without traces of male genital capsule
<i>Myrmilla calva</i> (VILLIERS 1789)	present paper	III	entirely female	entirely female	segments 1-5 female; segments 6-7 male, genital capsule of male present